SUSQUEHANNA RIVER BASIN

OFFSTREAM, HAZELET RUN, INDIANA COUNTY

PENNSYLVANIA

LEVEL II

PIONEER LAKE DAM

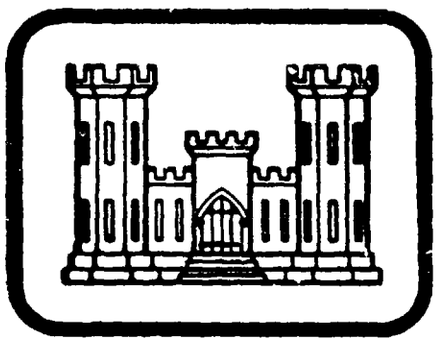
NDI ID NO. PA-431

DER ID NO. 32-80

PIONEER LAKE OUTDOOR CLUB

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM



Prepared By

L. ROBERT KIMBALL & ASSOCIATES

CONSULTING ENGINEERS & ARCHITECTS

EBENSBURG, PENNSYLVANIA

15931

FOR

DEPARTMENT OF THE ARMY

BALTIMORE DISTRICT CORPS OF ENGINEERS

BALTIMORE, MARYLAND

21203

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AUGUST 1981

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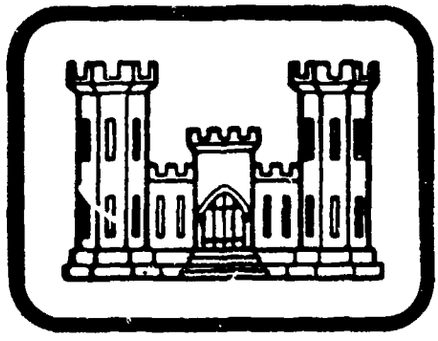

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in detemining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM INSPECTION REPORT

NAME OF DAM	Pioneer Lake Dam
STATE LOCATED	Pennsylvania
COUNTY LOCATED	Indiana
STREAM	Hazelet Run
DATE OF INSPECTION	June 4, 1981
COORDINATES	Lat: 40° 44.3' Long: 78° 51.3'

ASSESSMENT

The assessment of Pioneer Lake Dam is based upon visual observations made at the time of inspection, review of available records and data, hydraulic and hydrologic computations and past operational performance.

The dam and appurtenant structures appear to be in fair condition. No major erosion was observed on the embankment crest. An erosion area was observed at the outlet for the 12" diameter cast iron pipe. Erosion at the outlet of the 12" diameter pipe exists on the downstream slope of the dam near the toe. Seepage 100' right of the spillway channel was measured to be approximately 50 gallons per minute.

A 30" corrugated metal pipe exists beneath the roadway near the outlet for the emergency spillway. It was observed during the inspection that the pipe is collapsing near the center of the pipe. Trees were observed growing along the upstream edge of the crest, and dense vegetation was observed along the entire length of the downstream slope.

The Pioneer Lake Dam is a high hazard-small size dam. The recommended spillway design flood (SDF) for a dam of this size and classification is in the range of the 1/2 PMF to PMF. Due to the downstream potential for loss of life and property damage, the spillway design flood has been selected as the PMF. The spillway and reservoir are capable of controlling approximately 11% of the PMF without overtopping the embankment. Based on criteria established by the Corps of Engineers, the spillway is termed seriously inadequate. Pioneer Lake Dam is classified as unsafe, non-emergency.

The following recommendations and remedial measures should be instituted as soon as possible.

PIONEER LAKE DAM
PA 431

1. A detailed hydrologic and hydraulic analysis should be conducted by a registered professional engineer knowledgeable in dam design and analysis to increase the spillway capacity.

2. The observed seepage on the downstream slope of the dam should be investigated to determine its cause. The seepage should be evaluated as to its long term effects on the stability of the structure. The investigation of the seepage and an evaluation of its effect on the structure should be conducted by a registered professional engineer knowledgeable in dam design and analysis.

3. Erosion protection should be placed at the outlet of the 12" cast iron pipe to prevent erosion at the outlet.

4. No drainline exists for this dam. Some means should be devised to drain the reservoir which does not include a pressurized pipe through the embankment.

5. The observed brush and trees on the upstream edge of the crest and downstream slope of the dam should be removed under the direction of a registered professional engineer knowledgeable in dam design and analysis and proper erosion protection should be provided.

6. Minor erosion areas observed on the downstream slope due to motorbike traffic should be repaired, and continued use of the slopes as a trail should be discouraged and discontinued.

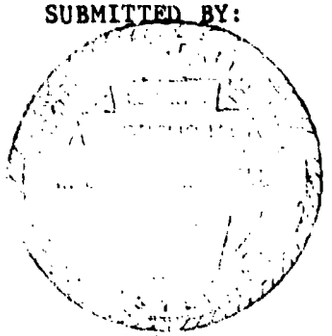
7. A regularly scheduled maintenance and operation plan should be planned and implemented to insure the continued safe operation of the structure.

8. A warning system should be developed to warn downstream residents of large spillway discharges or imminent failure of the dam.

9. A safety inspection program should be implemented with inspections implemented at regular intervals by qualified personnel.

SUBMITTED BY:

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS AND ARCHITECTS



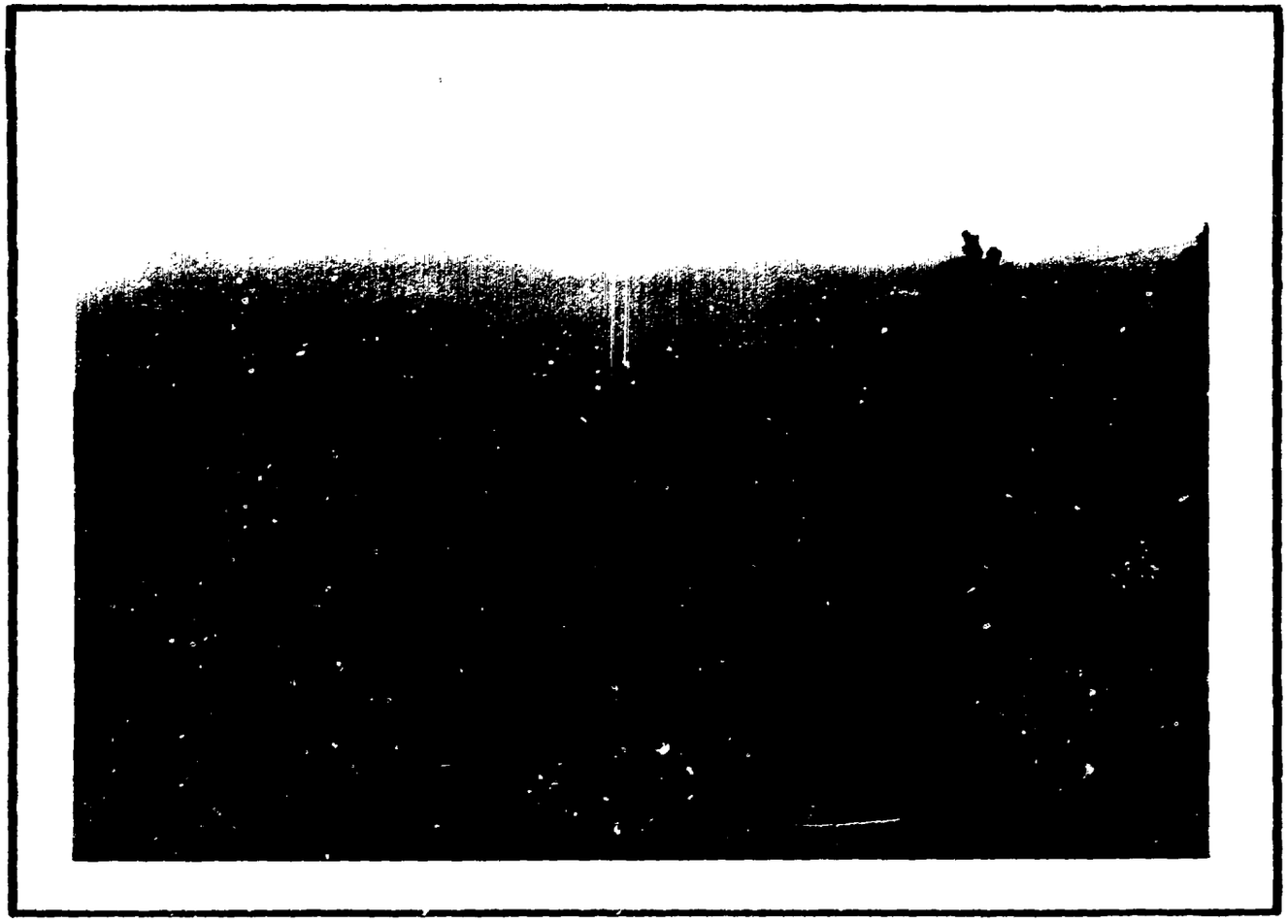
8/6/81
Date

R. Jeffrey Kimball
R. Jeffrey Kimball, P.E.

APPROVED BY:

28 Aug 81
Date

James W. Peck
JAMES W. PECK
Colonel, Corps of Engineers
District Engineer



Overview of Pioneer Lake Dam.

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PHASE I
NATIONAL DAM INSPECTION PROGRAM

PIONEER LAKE DAM
NDI. I.D. NO. PA 431
DER I.D. NO. 32-80

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. The Pioneer Lake Dam is an earthfill dam, 1300 feet long and 21 feet high. The crest width of the dam is 20 feet. The upstream slope was estimated to be 2H:1V. The downstream slope of the dam was measured to be 2.5H:1V. Small trees exist along the upstream slope of the dam, and the downstream slope is densely vegetated with brush and large trees.

The principal spillway consisting of a 12" cast iron pipe connected to an intake riser is located approximately 200 feet from the left abutment. The 12" pipe exists through the embankment and provides continuous discharge during normal pool conditions.

The emergency spillway for the dam is located at the left abutment and consists of a grass lined channel with an earthen roadway and culvert located at the outlet for the channel.

b. Location. The dam is located offstream of Hazelet Run, approximately 2 miles northwest of Cherry Tree, Montgomery Township, Indiana County, Pennsylvania. The Pioneer Lake Dam can be located on the Barnesboro, PA, U.S.G.S. 7.5 minute quadrangle.

c. Size Classification. The Pioneer Lake Dam is a small size dam (21 feet high, 172 acre-feet).

d. Hazard Classification. The Pioneer Lake Dam is a high hazard dam. Two homes are located to the east of the dam on Hazelet Run. A third home is located approximately 1/2 mile downstream of the dam.

The borough of Cherry Tree is located approximately 3.5 miles downstream of the dam. Loss of more than a few lives and property damage is probable should the structure fail. The two homes to the east of the dam are approximately located on the 1500 feet contour (26 feet below the top of dam).

e. Ownership. The Pioneer Lake Dam is owned by the Pioneer Lake Outdoor Club, Inc. Correspondence should be addressed to:

Pioneer Lake Outdoor Club, Inc.
568 North 5th Street
Indiana, Pennsylvania 15701
412/463-3710

f. Purpose of Dam. The Dam is utilized for the purposes of recreation by the Pioneer Lake Outdoor Club.

g. Design and Construction History. No detailed design or construction history was available regarding the dam. The site of the present dam was originally the location of a small farm pond. Sometime around 1957 the present embankment was constructed creating the existing lake. The dam was constructed by several members of the outdoor club. The Pioneer Outdoor Lake Club was formed sometime around 1966.

h. Normal Operating Procedures. No operations are conducted at the dam.

1.3 Pertinent Data.

a. Drainage Area. 0.22 square miles

b. Discharge at Dam Site (cfs).

Maximum flood at dam site	Unknown
Spillway capacity at top of dam	46 cfs

c. Elevation (MSL) (feet). - Field survey based on an assumed pool elevation, 1525.0, feet, U.S.G.S. 7.5 minute quadrangle.

Top of dam - low point	1525.8
Top of dam - design height	Unknown
Pool at time of inspection - estimated	1525.0
Normal pool	1525.0
Spillway crest (emergency)	1525.0
Maximum pool - design surcharge	Unknown
Top of riser inlet (principal spillway)	1525.0
Downstream invert - 12" cast iron pipe	1517.0
Maximum tailwater	Unknown
Toe of dam	1505.0

d. Reservoir (feet).

Length of maximum pool	1800
Length of normal pool	1800

e. Storage (acre-feet).

Spillway crest	153
Normal pool	153
Top of dam	172

f. Reservoir Surface (acres).

Top of dam	24
Normal pool	23
Spillway crest	23

g. Dam.

Type	Earthfill
Length	1300 feet
Height	21 feet
Top width	20 feet
Side slopes - upstream (estimated)	2H:1V
- downstream -	2.5H:1V
Zoning	None
Impervious core	None
Cutoff	None
Grout curtain	None

h. Reservoir Drain. (None)

i. Spillway. (Principal)

Type	12" diameter cast iron pipe with riser
Length (estimate)	60 feet
Crest elevation	1525.0

g. Spillway. (Emergency)

Type	Grass lined trapezoidal channel
Length (bottom width)	20 feet
Crest elevation	1525.0
Upstream channel	Lake (unrestricted)
Downstream channel	Tributary to Hazelet Run

SECTION 2
ENGINEERING DATA

2.1 Design. No detailed design information was available for review.

2.2 Construction. Only limited information exists regarding the construction of the dam. A member of the Pioneer Lake Outdoor Club, Mr. Murry Henry, was interviewed during the inspection with regards to the construction to the dam. Mr. Henry reported that the dam was constructed by several present day club members, sometime around 1957. He reported that the material utilized for the construction of the embankment was obtained from the reservoir area. No other information exists.

2.3 Operation. No operations are conducted at the dam.

2.4 Evaluation.

a. Availability. No engineering data exist for this dam. Information relative to the construction of the dam was provided by a member of the outdoor club.

b. Adequacy. This Phase I Report is based on the visual inspection and hydrologic and hydraulic analysis. Sufficient information exists to complete a Phase I Report.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The onsite inspection of Pioneer Lake Dam was conducted by personnel of L. Robert Kimball and Associates on June 4, 1981. Mr. Murry Henry, a representative of the Pioneer Lake Outdoor Club, was interviewed with regards to construction and maintenance of the dam. Mr. Henry did not accompany the inspection team during the inspection. The inspection consisted of:

1. Visual inspection of the retaining structure, abutments and toe.
2. Examination of the spillway facilities, exposed portion of any outlet works and other appurtenant works.
3. Observations affecting the runoff potential of the drainage basin.
4. Evaluation of the downstream area hazard potential.

b. Dam. The dam appeared to be in fair condition. Based on a brief survey conducted during the inspection, it was noted that the low spot on the embankment crest was located approximately 200 feet from the right abutment. It was observed that very little freeboard (less than 1 foot) existed at the dam. It was also observed during the inspection that a roadway exists along the entire length of the crest. The crest width of the dam was measured to be 20 feet. The upstream slope was estimated to be 2H:1V. Small trees were observed to exist along the entire length of the upstream edge of the crest. Dense vegetation was observed along the entire length of the dam along the downstream slope. The downstream slope was measured to be 2.5H:1V.

Seepage was observed on the downstream slope of the dam approximately 100 feet left of the outlet channel for the emergency spillway. This seepage was measured to be 50 gallons per minute.

c. Appurtenant Structures. Two spillways were observed for the dam. A principal spillway is located approximately 200 feet from the left abutment. The spillway consists of a 12" diameter cast iron pipe with an intake riser in the reservoir area. The outlet for the pipe is located on the downstream slope near the toe. Flow from the pipe discharges near the toe. The discharge from the pipe has eroded a portion of the embankment. It was noted during the inspection that no erosion control measures exist at the outlet.

The emergency spillway exists at the left abutment of the dam. The spillway consists of a grass lined channel with an earthen roadway and culvert at the outlet of the channel. A 30" diameter corrugated metal pipe is located beneath the earthen roadway. It was noted

during the inspection that the pipe appeared to be collapsing near the center of the pipe.

A pump house is located beyond the downstream toe, near the left abutment of the dam. The pump house is situated above the well and supplies water to residences near the lake.

d. Reservoir Area. The watershed area was observed to consist almost entirely of open fields. The reservoir slopes are moderate and are not susceptible to massive landslides, which would affect the storage volume of the reservoir or cause overtopping of the dam by displacing water.

e. Downstream Channel. The downstream channel for the Pioneer Lake Dam consists of Hazelet Run. The channel is relatively wide for a distance of approximately 1.5 miles, at which point flow in Hazelet Run discharges into Cush Cushion Creek. Two homes were observed to be located to the east of the dam and Hazelet Run. A third home is located approximately 1/2 mile downstream of the dam. It was noted during the inspection that the loss of more than a few lives and property damages are probable should the structure fail. The two homes to the east of the dam were estimated to be located on the 1500 foot contour (26 feet below the top of dam). Downstream population is estimated to equal 25 to 30 people.

3.2 Evaluation. Only 0.8 feet of freeboard exists at the dam. Although the watershed is relatively small (0.22 square mile), a relatively small amount of inflow would cause overtopping of the embankment at the low spot on the embankment crest. Minimal spillway capacity exists at the dam.

The observed seepage should be investigated and an evaluation of its effect on the stability of the structure determined.

The roadway and 30" corrugated metal pipe located at the outlet for the spillway channel was considered as affecting the discharge potential of the spillway during high head conditions. Since relatively little freeboard exists at the dam, overtopping of the embankment would occur prior to the effects of the roadway and culvert becoming significant.

Erosion protection should be provided at the outlet for the 12" cast iron pipe through the embankment.

No drainline was observed during the inspection. This condition is considered a deficiency, and a plan should be devised to drain the reservoir which does not include the construction of a pressurized line through the embankment.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures. The reservoir is presently maintained at the spillway crest elevation. No other procedures are conducted at the dam.

4.2 Maintenance of the Dam. No planned maintenance schedule exists for the dam. Maintenance is performed on an unscheduled, as-needed basis.

4.3 Maintenance of Operating Facilities. No planned maintenance exist. Maintenance of the facilities consist of unscheduled, as-needed maintenance of present facilities.

4.4 Warning System in Effect. There is no warning system in effect to warn downstream residents of imminent failure of the dam.

4.5 Evaluation. Maintenance of the dam and operating facilities is considered fair. A planned maintenance and operating schedule should be prepared and implemented to insure the continued safe operation of the facility.

An emergency action plan should be available for every dam in the high and significant hazard categories. Such plans should outline actions to be taken by the operator to miminize downstream affects of an emergency, and should include an effective warning system. No emergency action plan has been developed.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

a. Design Data. No hydraulic or hydrologic design was completed for the structure.

b. Experience Data. No rainfall, runoff or reservoir level data were available. The spillways have reportedly functioned adequately in the past.

c. Visual Observations. The spillways appear to be in fair condition and capable of discharging only minimal flow. The minimal flow associated with the spillway is due to the relatively low freeboard at the dam. It was noted during the inspection that less than 1 foot of freeboard existed at the structure.

The existence of a roadway and 30" corrugated metal pipe located at the outlet for the emergency spillway channel was observed as possibly affecting the discharge potential of the spillway during high head conditions. Since a high head condition is doubtful for this structure, the existence of the roadway and pipe were not considered during the hydrologic and hydraulic analysis. The low spot on the top of dam is determined to be located 200 feet from the right abutment.

d. Overtopping Potential. Overtopping potential was investigated through the development of the probable maximum flood (PMF) for the watershed and the subsequent routing of the PMF and fractions of the PMF through the reservoir and spillway.

The Corps of Engineers, Baltimore District, has directed that the HEC-1 Dam Safety Version systemized computer program be utilized. The program was prepared by the Hydrologic Engineering Center (HEC), U.S. Army Corps of Engineers, Davis, California, July 1978. The major methodologies or key input data for this program are discussed briefly in Appendix D.

5.2 Evaluation Assumptions. To enable completion of the hydraulic and hydrologic analysis for this structure, it was necessary to make the following assumptions.

1. The pool elevation in the reservoir prior to the storm was assumed to be at the spillway crest elevation, 1525.0.

2. The top of dam was considered to be at elevation 1525.8.

3. No discharge was considered through the 12" cast iron pipe through the embankment.

4. The effects of the roadway and culvert at the outlet for the emergency spillway channel was not considered as affecting the low head discharge potential through the spillway.

5.3 Summary of Overtopping Analysis. Complete summary sheets for the computer output are presented in Appendix D.

Peak inflow (PMF)	986 cfs
Spillway capacity	46 cfs

a. Spillway Adequacy Rating. The Spillway Design Flood (SDF) is based on the hazard and size classification of the dam. The recommended spillway design flood for a dam of this size and classification is in the range of 1/2 PMF to PMF. Based on the downstream potential for loss of life and property damage, the spillway design flood has been selected as the PMF.

Based on the following definition provided by the Corps of Engineers, the spillway is rated as inadequte as a result of our hydrologic analysis.

> Seriously Inadequate - High hazard classification dams not capable of passing 50% of the PMF and where there is a significant increase in the hazard potential for loss of life due to overtopping failure.

The spillway and reservoir are capable of controlling approximately 11% of the PMF without overtopping the embankment.

5.4 Summary of Dam Breach Analysis. As the subject dam cannot satisfactorily pass 50% of the PMF (based on the analysis performed for the report), it was necessary to perform a dam breach analysis and downstream routing of the flood wave. This analysis determined the degree of increased flooding due to dam failure. A pool elevation of 1526.5, representing (0.70 foot) of overtopping, was considered sufficient to cause failure of the dam due to overtopping.

The results of the dam breach analysis indicate that the downstream potential for loss of life and property damage is significantly increased by dam failure from that which would exist prior to overtopping. The increased momentum of flow associated with dam failure would cause devastating effects downstream. No warning of imminent failure would exist. Therefore, the spillway is rated as seriously inadequate. Details of the downstream routing of the flood wave are included in Appendix D.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. No major erosion areas were observed on the embankment crest. An erosion area was observed on the downstream slope of the dam and was created by motorbike traffic on the slope. A seepage area was observed near the downstream toe, approximately 100 feet right of the emergency spillway discharge channel. Seepage in the area was measured to be approximately 50 gallons per minute. No movement or misalignment of the embankment was observed during the inspection.

The outlet for the 12" diameter cast iron pipe is located on the downstream slope of the dam. Discharges from the principal spillway have created a minor erosion area at the base of the outlet in the area of the toe. No erosion protection was observed in the area. It was noted that continued erosion in the area has the potential to erode the toe of the dam and could potentially lead to failure of the embankment.

b. Design and Construction Data. No design or construction data were available relative to the dam. It was reported by a member of the Pioneer Lake Outdoor Club, Mr. Murry Henry, that the dam was constructed sometime around 1957. Material utilized in the construction of the embankment was obtained from the reservoir area.

c. Operating Records. No operating records exist for this dam.

d. Post Construction Changes. No post construction changes are known to have occurred.

e. Evaluation. No major deficiencies were observed during the inspection which were considered as having an immediate affect upon the static stability of the structure. Therefore, the Pioneer Lake Dam is considered to be statically stable at the present time. No calculations were completed to document this assumption.

The owner should be aware of the possibility of past or future mining beneath the dam and its potential affects relative to the stability of the structure.

f. Seismic Stability. The dam is located in seismic zone 1. No seismic stability analyses have been performed. Normally, if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake loading. No calculations have been completed to verify either static or seismic stability.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The dam and appurtenant structures appear to be in fair condition. Maintenance of the dam and appurtenant structures is completed on an unscheduled, as-needed basis. No major erosion was observed on the embankment crest. An erosion area was observed at the outlet for the 12" diameter cast iron pipe. The erosion at the outlet of the 12" diameter pipe exists on the downstream slope of the dam near the toe. The erosion, if left unchecked, could lead to potential failure of the embankment. Seepage was observed approximately 100 feet right of the outlet for the emergency spillway channel. Seepage in the area was measured to be approximately 50 gallons per minute. The low spot on the embankment crest was determined to be approximately 200 feet from the right abutment. The top of dam was observed to be irregular, and the top of dam should be filled to a consistent elevation throughout the entire length of the embankment. A 30" corrugated metal pipe exists beneath the roadway near the outlet for the emergency spillway. It was observed during the inspection that the culvert is collapsing near the center of the pipe. Trees were observed growing along the upstream edge of the crest, and dense vegetation was observed along the entire length of the downstream slope. The vegetation should be removed.

The Pioneer Lake Dam is a high hazard-small size dam. The recommended spillway design flood (SDF) for a dam of this size and classification is in the range of the 1/2 PMF to PMF. Due to the downstream potential for loss of life and property damage, the spillway design flood has been selected as the PMF. The Pioneer Lake Dam is capable of controlling approximately 11% of the PMF. The spillway is termed seriously inadequate since the dam would be likely to fail at flows less than 1/2 of the PMF and since failure would significantly increase the hazard to loss of life, the facility is classified as unsafe, non-emergency.

b. Adequacy of Information. Sufficient information is available to complete a Phase I report.

c. Urgency. The recommendations suggested below should be implemented as soon as possible.

d. Necessity for Further Investigation. In order to accomplish some of the recommendations/remedial measures outlined below, further investigations will be required.

7.2 Recommendations/Remedial Measures.

1. A detailed hydrologic and hydraulic analysis should be conducted by a registered professional engineer knowledgeable in dam design and analysis to increase the spillway capacity.

2. The observed seepage on the downstream slope of the dam should be investigated to determine its cause. The seepage should be evaluated as to its long term effects on the stability of the structure. The investigation of the seepage and an evaluation of its effect on the structure should be conducted by a registered professional engineer knowledgeable in dam design and analysis.

3. Erosion protection should be placed at the outlet of the 12" cast iron pipe to prevent erosion at the outlet.

4. No drainline exists for this dam. Some means should be devised to drain the reservoir which does not include a pressurized pipe through the embankment.

5. The observed brush and trees on the upstream edge of the crest and downstream slope of the dam should be removed under the direction of a registered professional engineer knowledgeable in dam design and analysis and proper erosion protection should be provided.

6. Minor erosion areas observed on the downstream slope due to motorbike traffic should be repaired, and continued use of the slopes as a trail should be discouraged and discontinued.

7. A regularly scheduled maintenance and operation plan should be planned and implemented to insure the continued safe operation of the structure.

8. A warning system should be developed to warn downstream residents of large spillway discharges or imminent failure of the dam.

9. A safety inspection program should be implemented with inspections implemented at regular intervals by qualified personnel.

APPENDIX A
CHECKLIST, VISUAL INSPECTION, PHASE I

CHECK LIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Pioneer Lake Dam COUNTY Indiana STATE Pennsylvania ID# PA 431

TYPE OF DAM Earthfill HAZARD CATEGORY High

DATE(s) INSPECTION June 4, 1981 WEATHER Clear and warm TEMPERATURE 70°

POOL ELEVATION AT TIME OF INSPECTION 1525.0-est. M.S.L. TAILWATER AT TIME OF INSPECTION None M.S.L.

INSPECTION PERSONNEL:

R. Jeffrey Kimball, P.E. - L. Robert Kimball and Associates

James T. Hockensmith - L. Robert Kimball and Associates

O.T. McConnell - L. Robert Kimball and Associates

O.T. McConnell
RECORDER

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None noted.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None noted.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Erosion noted on the downstream slope near the toe of the dam. Erosion due to discharges from the 12" diameter cast iron pipe.	The erosion should be repaired and erosion protection placed in the area.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Uneven crest.	Crest should be filled to a consistent elevation.
RIPRAP FAILURES	Not applicable.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Trees were observed along the upstream edge of the crest and along the entire downstream slope of the dam.	The brush and trees should be removed under the direction of a registered professional engineer.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Appeared to be all right.	
ANY NOTICEABLE SEEPAGE	Seepage observed on the downstream slope approximately 100 feet right of the outlet for the emergency spillway.	Seepage measured to be approximately 50 gallons per minute.
STAFF GAUGE AND RECORDER	None.	
DRAINS	None.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	Not applicable.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Not applicable.	
DRAINS	Not applicable.	
WATER PASSAGES	Not applicable.	
FOUNDATION	Not applicable.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Not applicable.	
STRUCTURAL CRACKING	Not applicable.	
VERTICAL AND HORIZONTAL ALIGNMENT	Not applicable.	
MONOLITH JOINTS	Not applicable.	
CONSTRUCTION JOINTS	Not applicable.	
STAFF GAUGE OR RECORDER	Not applicable.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Not applicable.	
INTAKE STRUCTURE	12" diameter pipe with riser.	
OUTLET STRUCTURE	12" diameter cast iron pipe.	Discharges from the pipe outlet on the downstream slope of the dam.
OUTLET CHANNEL	Tributary to Hazelet Creek.	
EMERGENCY GATE	None.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Control section for this dam consists of a grass lined open channel.	An earthen roadway with a 30" diameter corrugated metal pipe exists at the outlet for the channel.
APPROACH CHANNEL	Lake [unrestricted]	
DISCHARGE CHANNEL	Open channel to Hazelet Creek.	
BRIDGE AND PIERS	None.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Not applicable.	
APPROACH CHANNEL	Not applicable.	
DISCHARGE CHANNEL	Not applicable.	
BRIDGE AND PIERS	Not applicable.	
GATES AND OPERATION EQUIPMENT	Not applicable.	

DOWNSTREAM CHANNEL

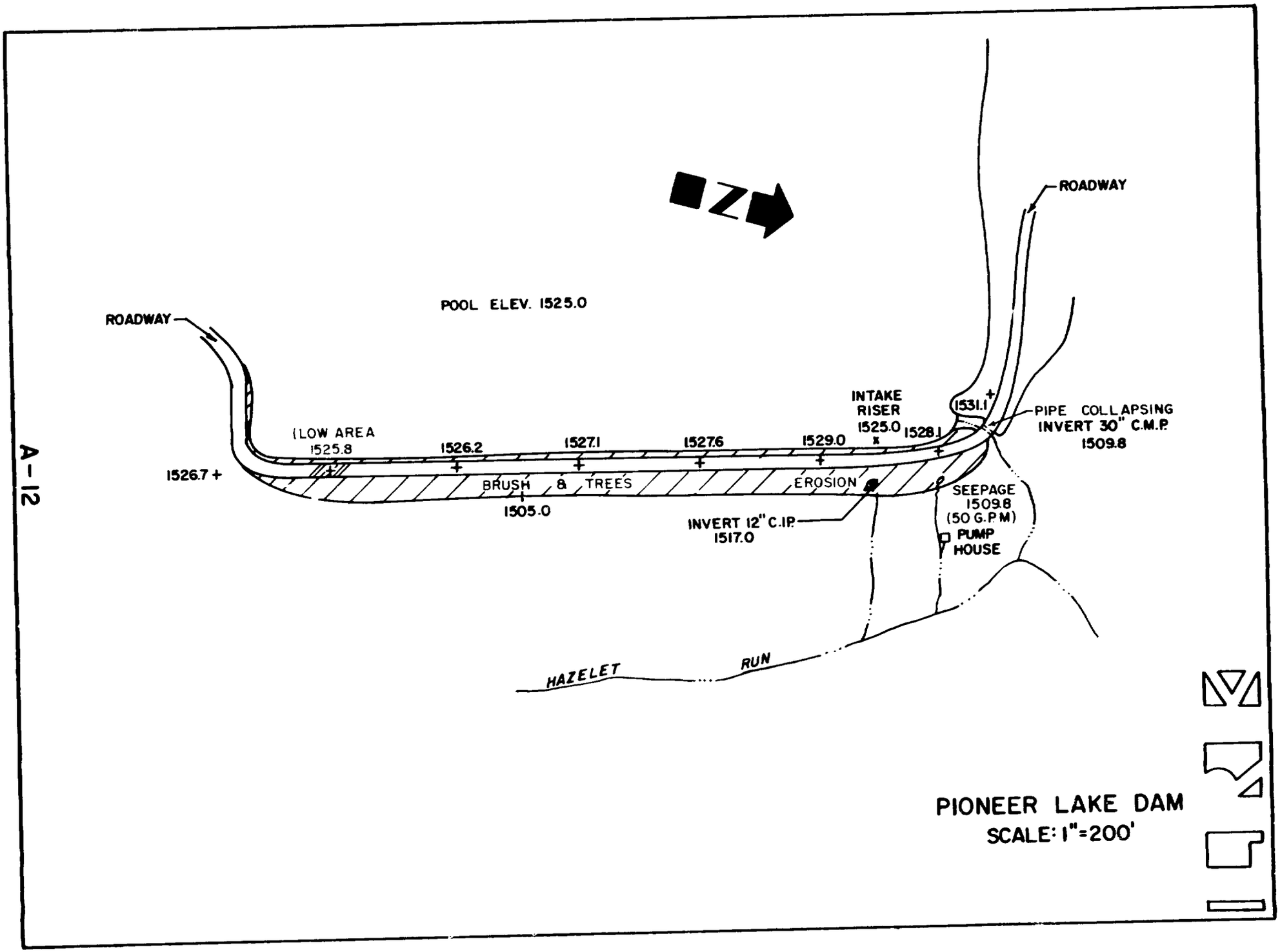
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream channel for the Pioneer Lake Dam consists of Hazelet Run. No major obstructions were observed in the channel.	
SLOPES	Appear to be stable.	
APPROXIMATE NO. OF HOMES AND POPULATION	Two homes are located to the east of the dam and Hazelet Run. A third home is located approximately 1/2 mile downstream of the dam. Population of the three homes is estimated at 10 to 12 people.	The two homes to the east of the dam are approximately located on the 1500 feet contour.

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Moderate and stable.	
SEDIMENTATION	Unknown.	

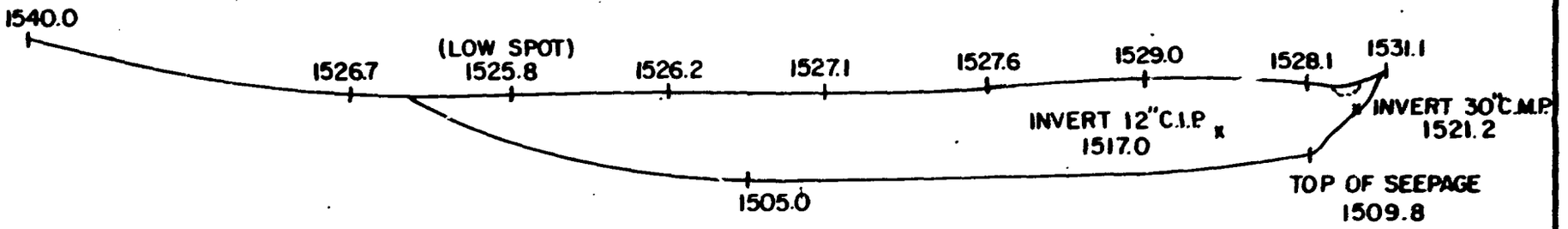
INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	



PIONEER LAKE DAM
SCALE: 1"=200'

A-12



PROFILE
LOOKING UPSTREAM
SCALE: HORIZ. 1"=200'
VERT. 1"= 20'

PIONEER LAKE DAM

A-13

APPENDIX-B
CHECKLIST, ENGINEERING DATA, DESIGN, CONSTRUCTION, OPERATION, PHASE I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Pioneer Lake Dam

ID# PA 431

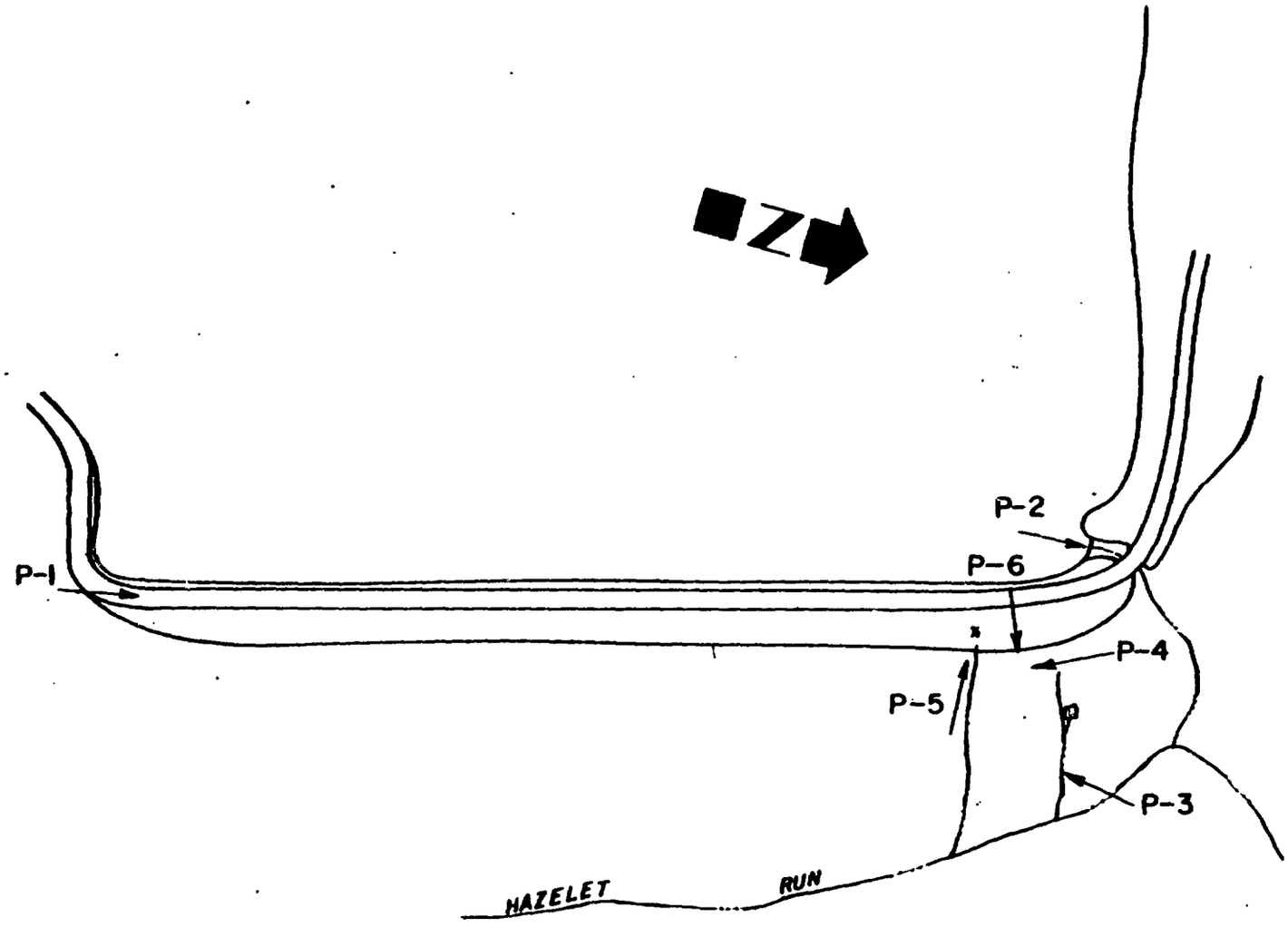
ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	U.S.G.S. quadrangle.
CONSTRUCTION HISTORY	Limited information from the owner.
TYPICAL SECTIONS OF DAM	None.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS RAINFALL/RESERVOIR RECORDS	None. None. None. None. None.

ITEM	REMARKS
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None.
POST-CONSTRUCTION SURVEYS OF DAM	None known to have occurred.
BORROW SOURCES	Reservoir area.

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	None known to have occurred.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None known to have exist.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None known to have occurred.
MAINTENANCE OPERATION RECORDS	None.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	None.
OPERATING EQUIPMENT PLANS & DETAILS	None.

APPENDIX-C
PHOTOGRAPHS



C-1

PIONEER LAKE DAM
PHOTO INDEX

P- INDICATES PHOTO LOCATION

PIONEER LAKE DAM
PA 431

Sheet 1

Front

(1) Upper left - View of across the crest of the dam. View towards the left abutment.
(2) Upper right - View of emergency spillway discharge channel. Note earthen roadway and 30" diameter corrugated metal pipe at the outlet.
(3) Lower left - View of seepage area on the downstream slope of the dam. Note overflow pipe from pump house.
(4) Lower right - View of seepage area and downstream slope of dam. Note dense vegetation on slopes.

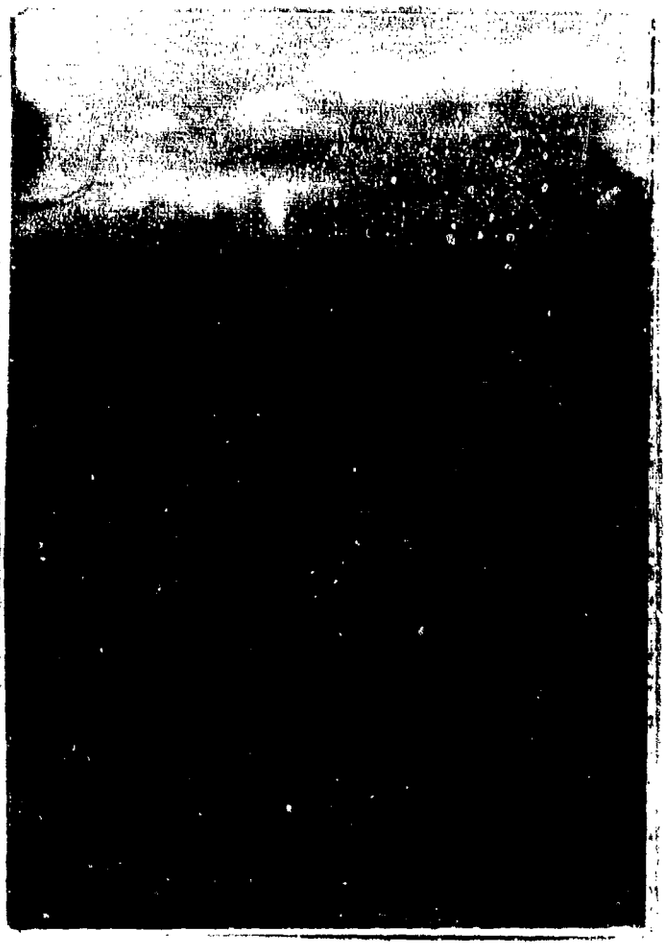
Sheet 1

Back

(5) Upper left - View of outlet for the 12" diameter cast iron pipe. Note erosion below the outlet.
(6) Upper right - Downstream exposure.

TOP OF PAGE

1,5	2,6
3	4



4

3

APPENDIX D
HYDROLOGY AND HYDRAULICS

APPENDIX D
HYDROLOGY AND HYDRAULICS

Methodology. The dam overtopping and breach analyses were accomplished using the systemized computer program HEC-1 (Dam Safety Investigation), September, 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. A brief description of the methodology used in the analysis is presented below.

1. Precipitation. The Probable Maximum Precipitation (PMP) is derived and determined from regional charts prepared from past rainfall records including "Hydrometeorological Report No. 33" prepared by the U.S. Weather Bureau.

The index rainfall may be reduced from 10% to 20% depending on watershed size by utilization of what is termed the HOP Brook adjustment factor. Distribution of the total rainfall is made by the computer program using distribution methods developed by the Corps.

2. Inflow Hydrograph. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for reservoir routing.

The unit hydrograph is developed using the Snyder method. This method requires calculation of several key parameters. The following list gives these parameters their definition and how they were obtained for these analysis.

Parameter	Definition	Where Obtained
Ct	Coefficient representing variations of watershed	From Corps of Engineers*
L	Length of main stream channel miles	From U.S.G.S. 7.5 minute topgraphic
Lca	Length on main stream to centroid of watershed	From U.S.G.S. 7.5 minute topographic
Cp	Peaking coefficient	From Corps of Engineers*
A	Watershed size	From U.S.G.S. 7.5 minute topographic

*Developed by the Corps of Engineers on a regional basis for Pennsylvania.

3. Routing. Reservoir routing is accomplished by using Modified Plus routing techniques where the flood hydrograph is routed through reservoir storage. Hydraulic capacities of the outlet works, spillways and the crest of the dam are used as outlet controls in the routing.

The hydraulic capacity of the outlet works can either be calculated and input, or sufficient dimensions input, and the program will calculate an elevation discharge relationship.

Storage in the pool area is defined by an area - elevation relationship from which the computer calculates storage. Surface areas are either planimetered from available mapping or U.S.G.S. 7.5 minute series topographic maps or taken from reasonably accurate design data.

4. Dam Overtopping. Using given percentages of the PMF, the computer program will calculate the percentage of the PMF, which can be controlled by the reservoir and spillway without the dam overtopping.

5. Dam Breach and Downstream Routing. The computer program is equipped to determine the increase in downstream flooding due to failure of the dam caused by overtopping. This is accomplished by routing both the pre-failure peak flow and the peak flow through the breach (calculated by the computer with given input assumptions) at a given point in time and determining the water depth in the downstream channel. Channel cross-sections taken from U.S.G.S. 7.5 minute topographic maps were used in the downstream flood wave routing. Pre and post failure water depths are calculated at locations where cross-sections are input.

HYDROLOGY AND HYDRAULICS ANALYSIS
DATA BASE

NAME OF DAM: Pioneer Lake Dam

PROBABLE MAXIMUM PRECIPITATION (PMP) = 23.5 inches

STATION	1	2	3
Station Description	Pioneer		
Drainage Area (square miles)	0.22		
Cumulative Drainage Area (square miles)	0.22		
Adjustment of PMF for Drainage Area (%)(1)	(Zone 7)		
6 hours	102		
12 hours	120		
24 hours	130		
48 hours	140		
72 hours	N/A		
Snyder Hydrograph Parameters	(Zone 19)		
Zone (2)			
Cp (3)	0.45		
Ct (3)	1.84		
L (miles) (4)	0.34		
Lca (miles) (4)	0.09		
tp = Ct(LxLca) 0.3 hrs.	0.65		
Spillway Data (emergency)			
Crest Length (ft)	20		
Freeboard (ft)	0.8		
Discharge Coefficient	3.2		
Exponent	1.5		

(1) Hydrometeorological Report 33 (Figure 1), U.S. Weather Bureau and U.S. Army Corps of Engineers, 1956.
(2) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's coefficients (C_p and C_t).
(3) Snyder's Coefficients.
(4) L=Length of longest water course from outlet to basin divide. L_{ca}=Length of water course from outlet to point opposite the centroid of drainage area.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 0.22 sq.mi.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1525.0 [153 ac-ft]

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1525.8 [172 ac-ft]

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 1525.8

SPILLWAY CREST:

a. Elevation 1525.0
b. Type Grass lined trapezoidal channel
c. Width Bottom width = 20 feet
d. Length 100 feet
e. Location Spillover Left abutment
f. Number and Type of Gates None

OUTLET WORKS:

a. Type 12" diameter cast iron pipe with riser
b. Location In reservoir
c. Entrance inverts 1525.0 [estimated]
d. Exit inverts 1517.0
e. Emergency drawdown facilities None

HYDROMETEOROLOGICAL GAUGES:

a. Type None
b. Location None
c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

NOTE: Elevations refer to MSL.

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CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

NAME PIONEER LAKE DAM
NUMBER PA. 431
SHEET NO. 1 OF 5
BY OTM DATE 6/81

LOSS RATE AND BASE FLOW PARAMETERS

STRTL = 1 INCH
CNSTL = 0.05 IN/HR
STRTQ = 1.5 C.F.S. /MI.^{2}
QRCSN = 0.05 (5% OF PEAK FLOW)
RTIOR = 2.0

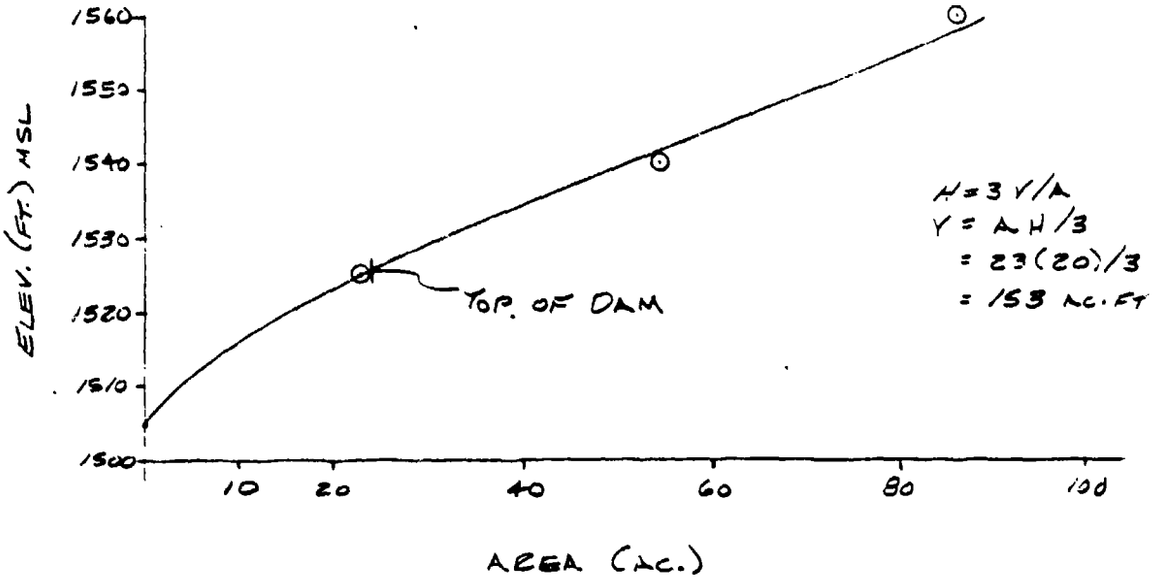
AS RECOMMENDED BY THE BALTIMORE DISTRICT CORPS OF ENGINEERS.

ELEVATION-AREA-CAPACITY RELATIONSHIPS

FROM U.S.G.S. 7.5 MIN. QUADRANGE AND FIELD INSPECTION DATA.

SPILLWAY CREST AT ELEVATION = 1525.0

ASSUME ZERO STORAGE AT ELEVATION = 1505.0
SURFACE AREA AT NORMAL POOL = 23 ACRES
AT ELEV. 1540, AREA = 55 AC.
AT ELEV. 1560, AREA = 87 AC.



AREA (AC)	0	23	24	55
ELEV. (FT.)	1505	1525	1525.8	1540

DISCHARGE RATING CURVE

VERY LITLE DISCHARGE CAPACITY EXISTS AT THE DAM. THE FREEBOARD AT THE TIME OF INSPECTION EQUALLED 0.80'.

THE CONTROL SECTION FOR THE SPILLWAY EXISTS AT THE INLET OF THE DISCHARGE CHANNEL AT THE LEFT ABUTMENT. THE CHANNEL IS TRAPEZOIDAL BUT SINCE VERY LITLE FREEBOARD EXIST THE STANDARD WEIR EQUATION WILL BE USED TO SIMPLIFY THE ANALYSIS. THE DISCHARGE WILL BE DETERMINED BY (HEC-1).

$$	1525.0	20'	3.2	1.5

OVERTOPPING WILL BE DETERMINED BY (HEC-)

$L	20'	640'
$Y	1525.8	1527.0

USE C = 2.9
L = 20' @ EL. 1525.8

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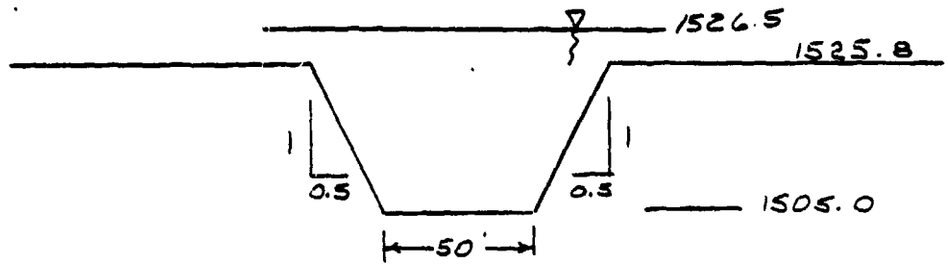
EBENSBURG PENNSYLVANIA

NAME
NUMBER PA-431
SHEET NO. 3 OF 5
BY DGM DATE 7-81

BREACH ANALYSIS



BRWID = 50'
Z = 0.5'
ELBM = 1505.0
TFAIL = 2 HRS.
WISEL = 1525.0
FAILEL = 1526.5

CONSIDER 0.70' OF OVERTOPPING SUFFICIENT TO CAUSE FAILURE OF THE STRUCTURE.

NOTE: A PIPING FAILURE IN THE AREA OF THE OBSERVED SEEPAGE WOULD CAUSE DAMAGE AT REACH No. 1. REACH CROSS-SECTION SHOWN BUT ROUTING TECHNIQUE IS NOT AVAILABLE TO MODEL EFFECTS.

AN ELEVATION DIFFERENCE OF APPROX. 26 FEET EXISTS BETWEEN THE TOP OF DAM AND HOMES ON THE 1500 FEET CONTOUR. THE HOMES ARE LOCATED APPROX. 500 FEET BEYOND THE DOWNSTREAM TOE. A RAPID FAILURE OF THE DAM WOULD MOST LIKELY CAUSE LOSS OF LIFE. NO WARNING WOULD PRECEED A RAPID FAILURE.

OVERTOPPING FAILURE ASSUMED TO OCCUR IN THE AREA OF THE LOW SPOT (DOWNSTREAM OF REACH No. 1).

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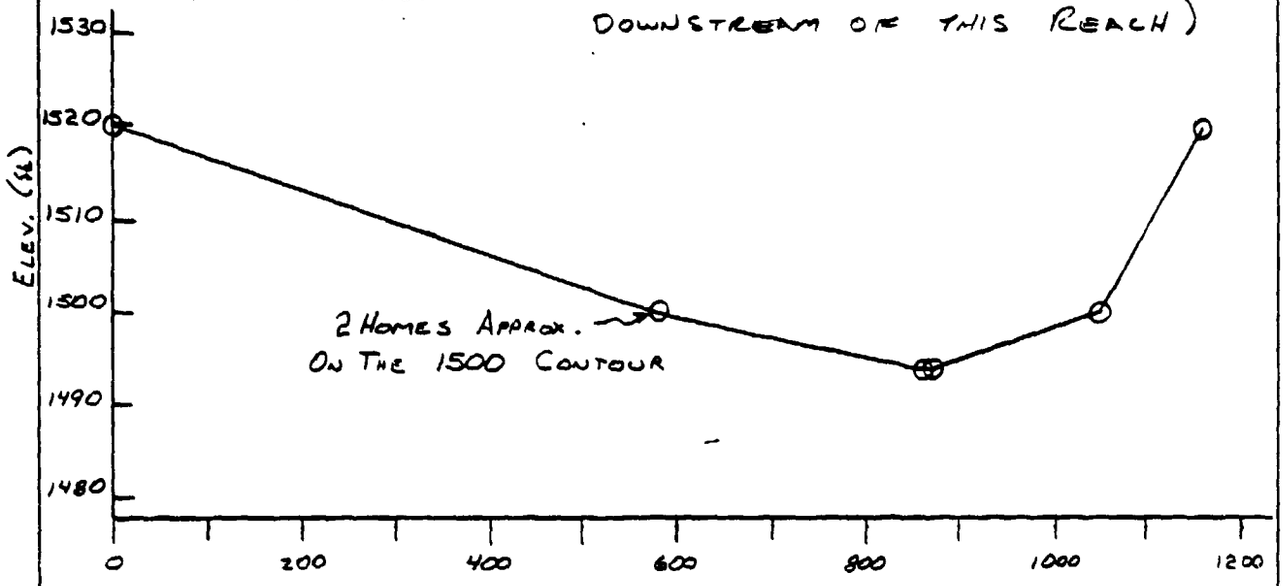
EBENSBURG PENNSYLVANIA

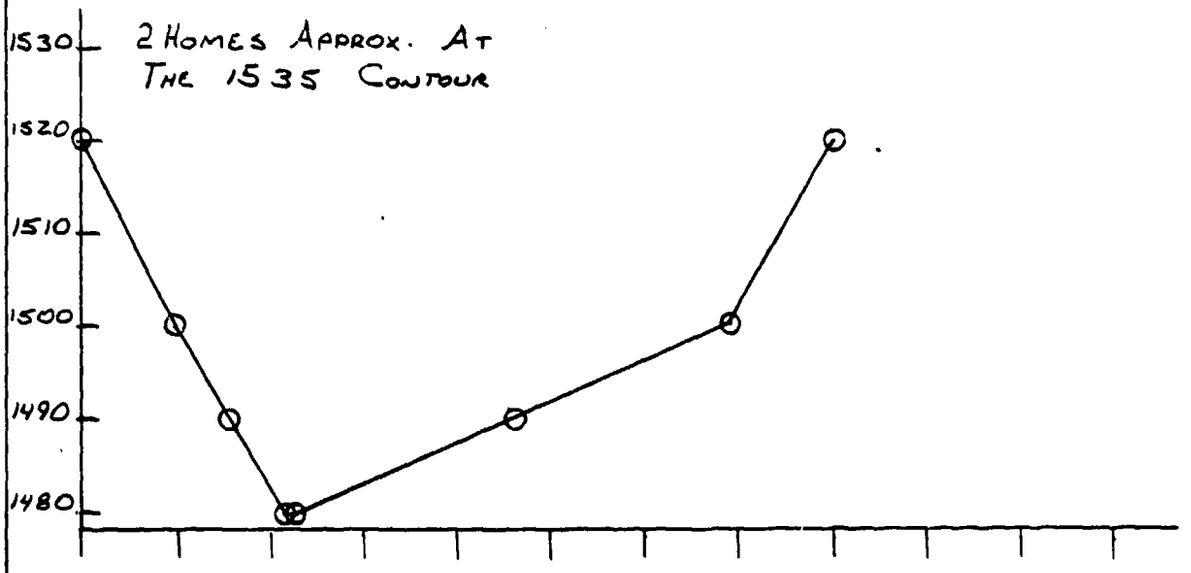
NAME
NUMBER PA-431
SHEET NO. 4 OF 5
BY DGM DATE 7-81

CHANNEL ROUTING

REACH NO. 1 (BRANCH ASSUMED TO OCCUR DOWNSTREAM OF THIS REACH)



REACH NO. 2 (STATION No 3)



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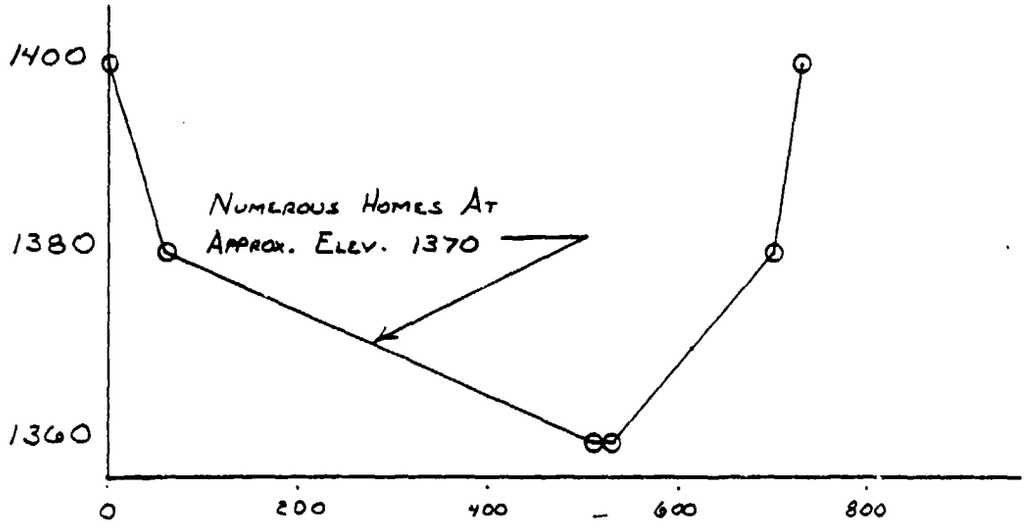
EBENSBURG PENNSYLVANIA

NAME
NUMBER PA-431
SHEET NO. 5 OF 5
BY DGM DATE 7-81

REACH NO. 3 (STATION NO. 4) AT CHERRY TREE.



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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  01 APR 80
**********
    1          AI       ANALYSIS OF DAM OVERTOPPING USING RATIOS OF THE PMF
    2          A2       HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF PIONEER LAKE DAM
    3          A3       RATIOS OF THE PMF ROUTED THROUGH THE RESERVOIR   (PA-431)
    4          B     288        0         5         0         0         0         0         0        -4         0
    5          B1      5
    6          J       1         5         1
    7          J1    .10       .15       .2        .5        1
    8          K       0         1                                     1
    9          K1       INFLOW
   10          M       1         1       0.22                                1                   1
   11          P                2345      102       120       130
   12          I                                                                       1.0       0.05
   13          W     0.65      0.45
   14          X     -1.5      -.05      2.0
   15          K       1         2                                               1
   16          K1       ROUTE
   17          Y                                              1         1
   18          Y1      1                                                        -1525
   19          SA      0        23        24        55
   20          SE   1505      1525    1525.8      1540
   21          SS   1525        20       3.2       1.5
   22          SV1525.8       2.9       1.5        20
   23          SL     20       .640
   24          SV1525.8      1527
   25          K      99
```

D-10

****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 01 APR 80
****

RUN DATE 81707717.
TIME 09.32.26.

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF THE PMF
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF PIONEER LAKE DAM
RATIOS OF THE PMF ROUTED THROUGH THE RESERVOIR (PA-431)

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	5	0	0	0	0	0	-4	0

JOPER	NWT	CROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 5 LRTIO= 1

RTIOS= .10 .15 .20 .90 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.22	0.00	.22	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.50	102.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= .65 CP= .45 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 73 END-OF-PERIOD ORDINATES, LAG= .65 HOURS, CP= .45 VOL= 1.00

4.	15.	31.	49.	68.	83.	94.	99.	96.	89.
82.	76.	70.	65.	60.	55.	51.	47.	44.	40.
37.	34.	32.	29.	27.	25.	23.	21.	20.	18.
17.	15.	14.	13.	12.	11.	10.	10.	9.	8.
8.	7.	6.	6.	5.	5.	5.	4.	4.	4.
3.	3.	3.	3.	2.	2.	2.	2.	2.	2.
2.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.									

0
MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP Q

END-OF-PERIOD FLOW
MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP Q

SUM 30.55 28.65 1.90 48146.
(776.) (728.) (48.) 1363.34

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1525.	0

SURFACE AREA=	0.	23.	24.	55.
CAPACITY=	0.	153.	172.	718.
ELEVATION=	1505.	1525.	1526.	1540.

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CARLA	EXPL
1525.0	20.0	3.2	1.5	0.0	0.0	0.0	0.0

DAM DATA
TOPEL COOD EXPD DAMWID

1525.8 2.9 1.5 20.

CREST LENGTH 20. 640.
AT OR BELOW
ELEVATION 1525.8 1527.0

PEAK OUTFLOW IS 43. AT TIME 18.50 HOURS

PEAK OUTFLOW IS 81. AT TIME 17.92 HOURS

PEAK OUTFLOW IS 132. AT TIME 17.33 HOURS

PEAK OUTFLOW IS 448. AT TIME 16.50 HOURS

PEAK OUTFLOW IS 937. AT TIME 16.42 HOURS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS				
				RATIO 1 .10	RATIO 2 .15	RATIO 3 .20	RATIO 4 .50	RATIO 5 1.00
HYDROGRAPH AT	1	.22	1	99.	148.	197.	493.	986.
		(.57)		(2.79)	(4.19)	(5.58)	(13.96)	(27.92)
ROUTED TO	2	.22	1	43.	81.	132.	445.	937.
		(.57)		(1.21)	(2.29)	(3.73)	(12.59)	(26.54)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 •••••••••••••••		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	1525.00	1525.00	1525.80
	STORAGE	153.	153.	172.
	OUTFLOW	0.	0.	48.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1525.76	0.00	171.	43.	0.00	18.50	0.00
.15	1526.00	.20	177.	81.	4.00	17.92	0.00
.20	1526.14	.34	180.	132.	5.00	17.33	0.00
.50	1526.54	.74	190.	445.	8.83	16.50	0.00
1.00	1526.87	1.07	199.	937.	13.00	16.42	0.00

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********
    1              A1,     RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM
    2              A2      DOWNSTREAM CONDITIONS DUE TO OVERTOPPING OF PIONEER LAKE DAM
    3              A3      PLAN 1 ASSUMES BREACH, PLAN 2 ASSUMES NO BREACH
    4              B    288       0       5       0       0       0       0       0       0       0
    5              B1     5
    6              J      2       1       1
    7              J1   0.5
    8              K      0       1                                               1
    9              K1      INFLOW
   10              M      1       1    0.22                               1                       1
   11              P             23.5     102     120     130
   12              T                                                               1.0    0.05
   13              W    0.65    0.45
   14              X    -1.5    -.05     2.0
   15              K      1       2                                               1
   16              K1      ROUTE
   17              Y                                       1       1
   18              Y1     1                                                       -1525
   19              $A     0      23      24      55
   20              $E  1505    1525  1525.8    1540
   21              $S  1525      20     3.2     1.5
   22              $D1525.8     2.9     1.5      20
   23              $L    20     640
   24              $V1525.8    1527
   25              $B    50     0.5    1505       2    1525  1526.5
   26              $B    50     0.5    1505       2    1525    1530
   27              K      1       3                                               1
   28              K1      MOD-PULS STREAM ROUTING (REACH LOCATION 2)
   29              Y                                       1       1
   30              Y1     1
   31              Y6   .06     .05     .06    1480    1520    3600   0.008
   32              Y7     0    1520     100    1500     160    1490     218    1480     230    1480
   33              Y7   462    1490     695    1500     802    1520
   34              K      1       4                                               1
   35              K1      MOD-PULS STREAM ROUTING (REACH LOCATION 3)
   36              Y                                       1       1
   37              Y1     1
   38              Y6   .06     .05     .06    1360    1400   15000     .01
   39              Y7     0    1400      60    1380     280    1370     510    1360     530    1360
   40              Y7   620    1370     700    1380     730    1400
   41              K     99
```

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS .50
HYDROGRAPH AT	1	.22 (.57)	1	493. (13.96)
			2	493. (13.96)
ROUTED TO	2	.22 (.57)	1	2863. (81.08)
			2	445. (12.59)
ROUTED TO	3	.22 (.57)	1	2782. (78.78)
			2	434. (12.30)
ROUTED TO	4	.22 (.57)	1	1861. (52.70)
			2	326. (9.22)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1525.00	1525.00	1525.80
STORAGE	153.	153.	172.
OUTFLOW	0.	0.	46.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1526.53	.73	190.	2874.	3.54	17.54	16.25

PLAN 2 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1525.00	1525.00	1525.80
STORAGE	153.	153.	172.
OUTFLOW	0.	0.	46.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1526.54	.74	190.	445.	8.83	16.50	0.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW.CFS	MAXIMUM STAGE.FT	TIME HOURS
.50	2782.	1485.4	17.67

PLAN 2 STATION 3

RATIO	MAXIMUM FLOW.CFS	MAXIMUM STAGE.FT	TIME HOURS
.50	434.	1482.4	16.75

PLAN 1 STATION 4

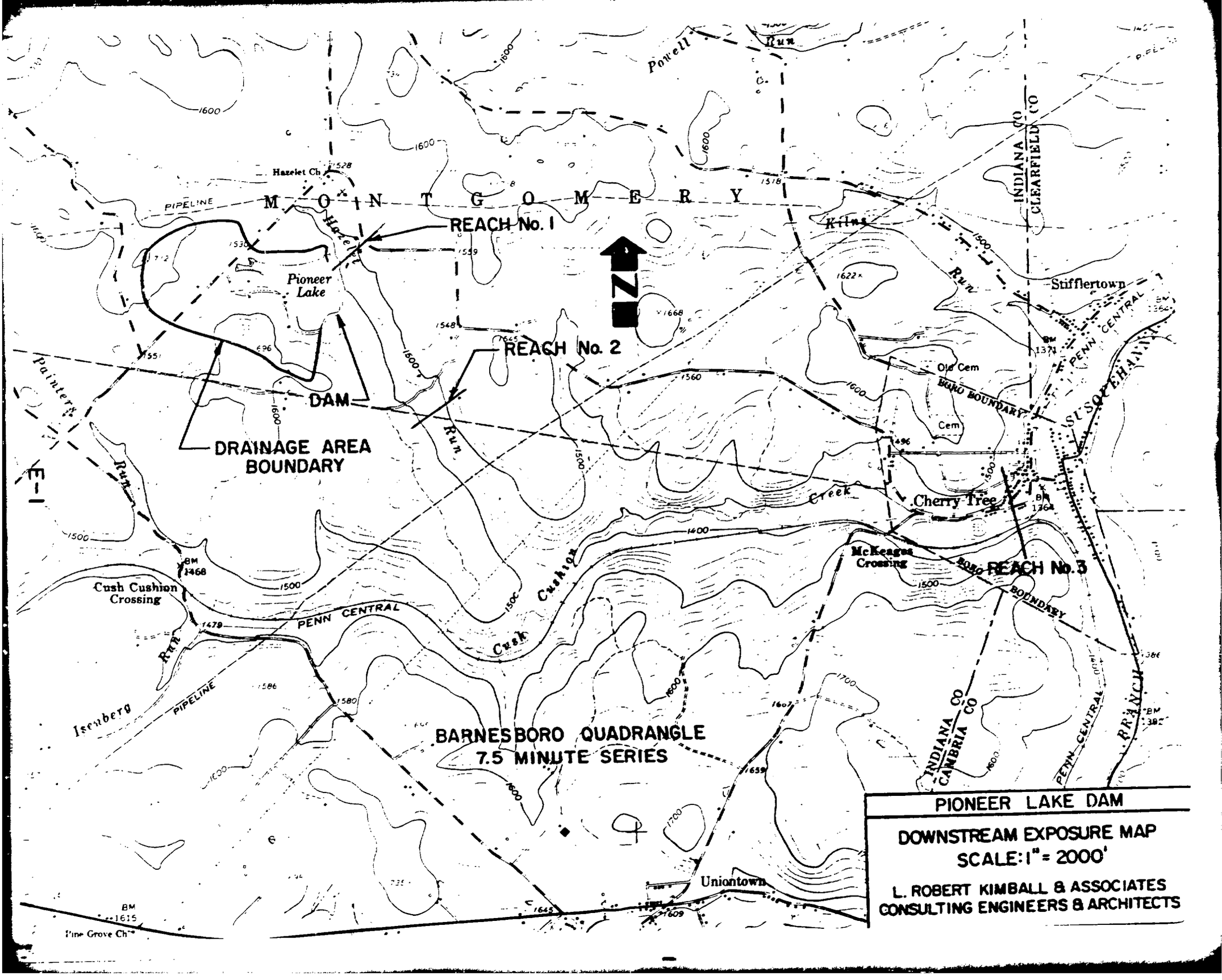
RATIO	MAXIMUM FLOW.CFS	MAXIMUM STAGE.FT	TIME HOURS

.50	1861.	1364.1	18.00

PLAN 2 STATION 4

RATIO	MAXIMUM FLOW.CFS	MAXIMUM STAGE.FT	TIME HOURS
.50	326.	1361.7	17.83

APPENDIX E
DRAWINGS

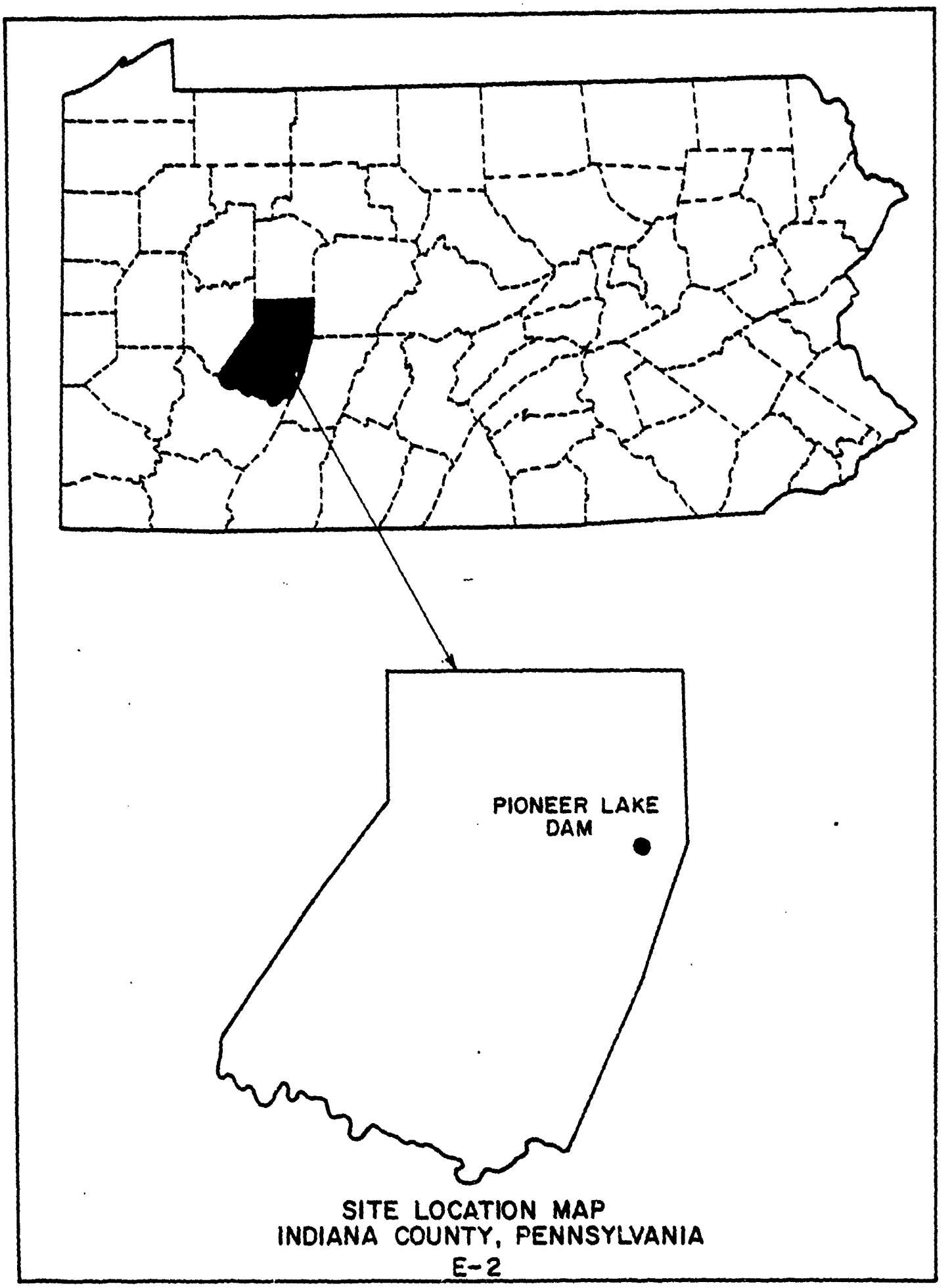


PIONEER LAKE DAM

DOWNSTREAM EXPOSURE MAP

SCALE: 1" = 2000'

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS



SITE LOCATION MAP
INDIANA COUNTY, PENNSYLVANIA

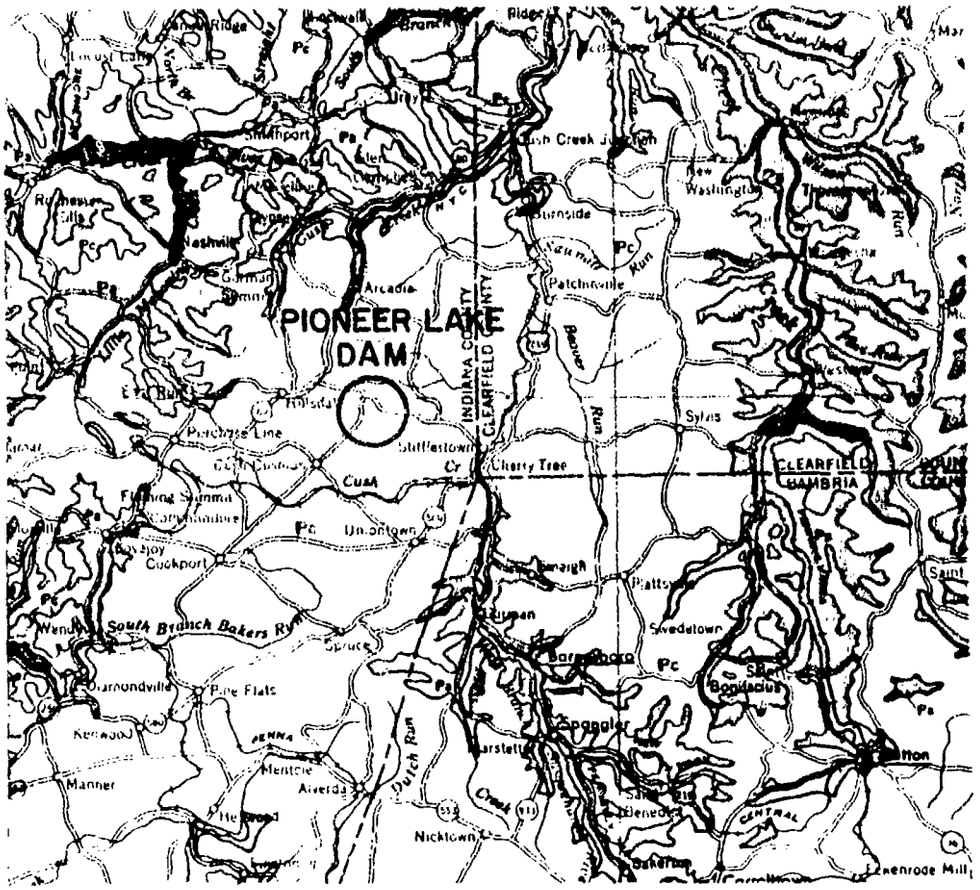
E-2

APPENDIX F
GEOLOGY

General Geology

The Pioneer Lake Dam is located in the Allegheny Mountain Section of the Appalachian Plateaus Province. This section lies between the Pittsburgh Plateaus Section to the west and Valley and Ridge Province to the east. It is typified by rather open folds with flank dips generally ranging between 5 and 20 degrees. The folding is more intense than the folding in the Pittsburgh Plateau Section, but is unlike the Valley and Ridge Province in that the valleys between the ridges stand relatively high and are underlain by rather gently inclined strata. There is a structural parallellism of northeast-trending ridges. The Pioneer Lake Dam lies on the western limb of the Brush Valley Syncline, which is the common flank of the Chestnut Ridge Anticline. The strike of the strata is N55°E in the area of the dam, and the dip is about 1° to the southeast. No major faulting is noted in the area.

Pioneer Lake Dam is underlain by rock belonging to the Conemaugh Formation of Pennsylvanian Age. In this area, the upper part of the formation has been removed by erosion; probably at least 300 feet of the total thickness, 900 feet. The strata consists of alternate beds of sandstone and shale of irregular thickness and character along with minor beds of limestone and thin coals. The coal beds are locally workable. The Conemaugh Formation overlies the Allegheny Group which contains many coal seams, several of economic importance. However, the dam lies about 150 feet above the Upper Freeport coal which is the top of the Allegheny Group, and over 300 feet above the Lower Kittanning coal. As of data obtained in 1974, none of the coal seams of the Allegheny Group were known to be mined out.



GEOLOGIC MAP OF THE AREA AROUND THE PIONEER LAKE DAM

SCALE 1:250,000

PENNSYLVANIAN

APPALACHIAN PLATEAU

Pm — **Monongahela Formation**

Cyclic sequences of sandstone, shale, limestone and coal, limestone prominent in northern outcrop areas, shale and sandstone increase southward; commercial coals present base at the bottom of the Pittsburgh Coal

Pc — **Conemaugh Formation**

Cyclic sequences of red and gray shales and siltstones with thin limestones and coals, massive Mahoning Sandstone commonly present at base, Ames Limestone present in middle of sections, Brush Creek Limestone in lower part of section.

Pa — **Allegheny Group**

Cyclic sequences of sandstone shale, limestone, and coal, numerous commercial coals, limestones Brush Creek westward Vanport Limestone in lower part of section, includes Freeport, Kittanning, and Clarion Formations

Pp — **Pottsville Group**

Predominantly sandstones and conglomerates with thin shale and coals, some coals mineable locally